Magnetic Behavior in Nanoscale Magnetic Heterostructures, DMR 0200254

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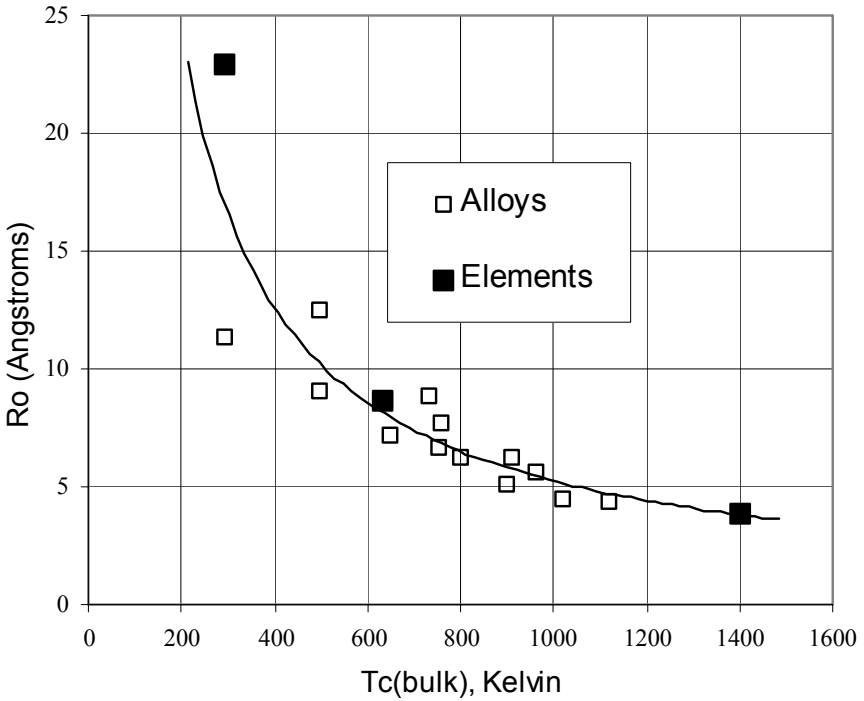
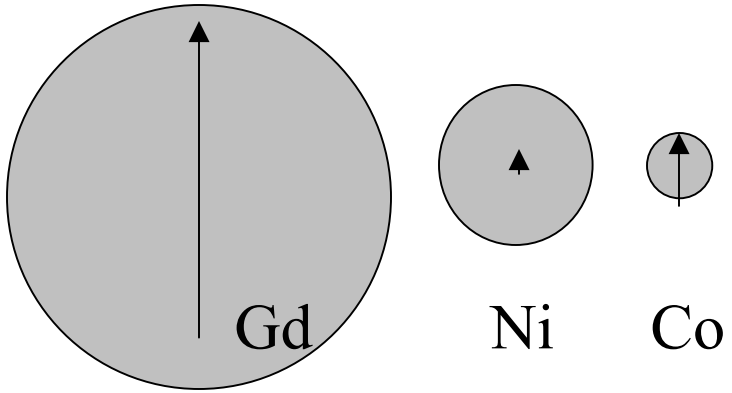
Magnetic behavior is a collective phenomena involving spin fluctutations that extend over a wide length scale. The spin-spin correlation length is a fundamental quantity that determines how the magnetic order decays to zero with increasing temperature. Plotting this ordering temperature Tc as a function of the thickness of thin films reveals a dependence on this intrinsic range of spin-spin interactions, Ro, Figure 1. [R. Zhang & R.F. Willis, Phys. Rev. Letters 86 2665, 2001]

Spin-based electronic devices ('spintronics') involve a similar magnetic coupling between thin-film magnets in nanoscale heterostructures ('spin valves'). The strength of this coupling depends on the range of the spin interactions Ro, which can be 'tuned' by alloying the various magnetic elements (see figure).





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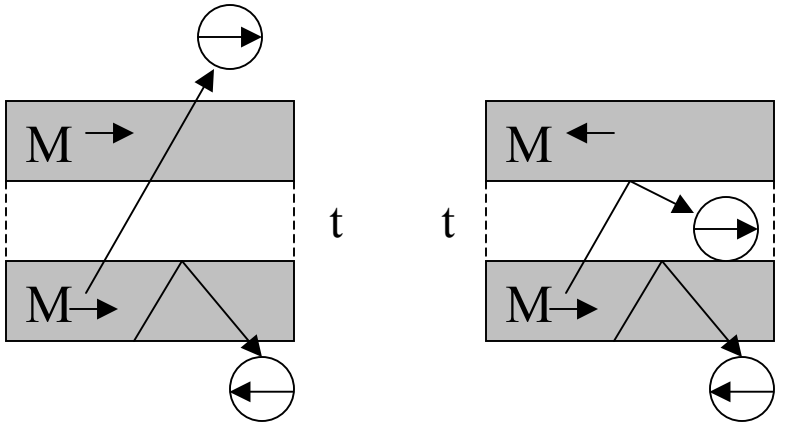
- Outreach
  - NSF-REU Summer Program
  - Materials Research Institute for interdisciplinary science at Penn State
- National Synchrotron Radiation Source Facilities, ALS Berkeley & SRC Wisconsin
- New Graduate Physics course on "Spintronics" initiated Spring 2004



spin filter "on" spin filter "off"

Magnetic heterostructures employed as valves to switch on/off spin currents in new spin-based digital electronic devices ('spintronics')